UNIVERSITÀ DEGLI STUDI DI PALERMO

SAAF DIPARTIMENTO SCIENZE AGRARIE ALIMENTARI FORESTALI 80 1942 2022 Studi Universitari Scienze Agrarie

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Intensive learning and teaching course

WOOD IN CIRCLE

Circular Economy in Wooden Construction (WOOD in CIRCLE)

Project number: 2020-1-LT01-KA203-077939

Sustainable forest management for a sustainable wood supply chain: the origin of wood

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Why this title?

Because everyone (more or less)
says wood is…

Wood is GREEN

Wood is renewable

Wood is a 0-emissions material

Wood is warm

Wood is cool

…..

Wood is GREEN

Wood is renewable

Wood is a 0-emissions material

Wood is warm

Wood is cool

.....

Wood is

SUSTAINABLE

Wood is GREEN

Wood is renewable

Wood is a 0-emissions material

Wood is warm

Wood is cool

.....

Wood is

SUSTAINABLE

Always True?

Sustainable forest management for a sustainable wood supply chain: the origin of wood

Forest Management approaching to Sustainable Development

Development that meets the needs of the present without compromising the ability of future generations to meet their own needs

SUSTAINABLE DEVELOPMENT GOALS

Wood is GREEN

Wood is renewable

Wood is a 0-emissions material

Wood is warm

Wood is cool

.....

Wood is

SUSTAINABLE

Always True?

Wood is SUSTAINABLE

Wood is GREEN

In terms of color…

In terms of sustainability… it depends

Wood is warm

Wood is cool

It is (mainly)

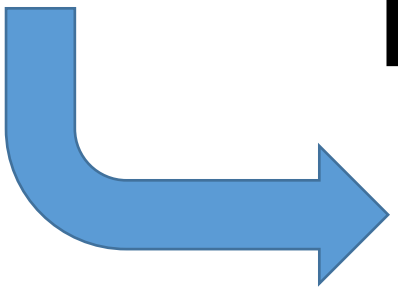
Marketing

Wood is SUSTAINABLE

Wood is a 0-emissions material → ✗

(Low emissions, yes)

Wood is renewable ✓

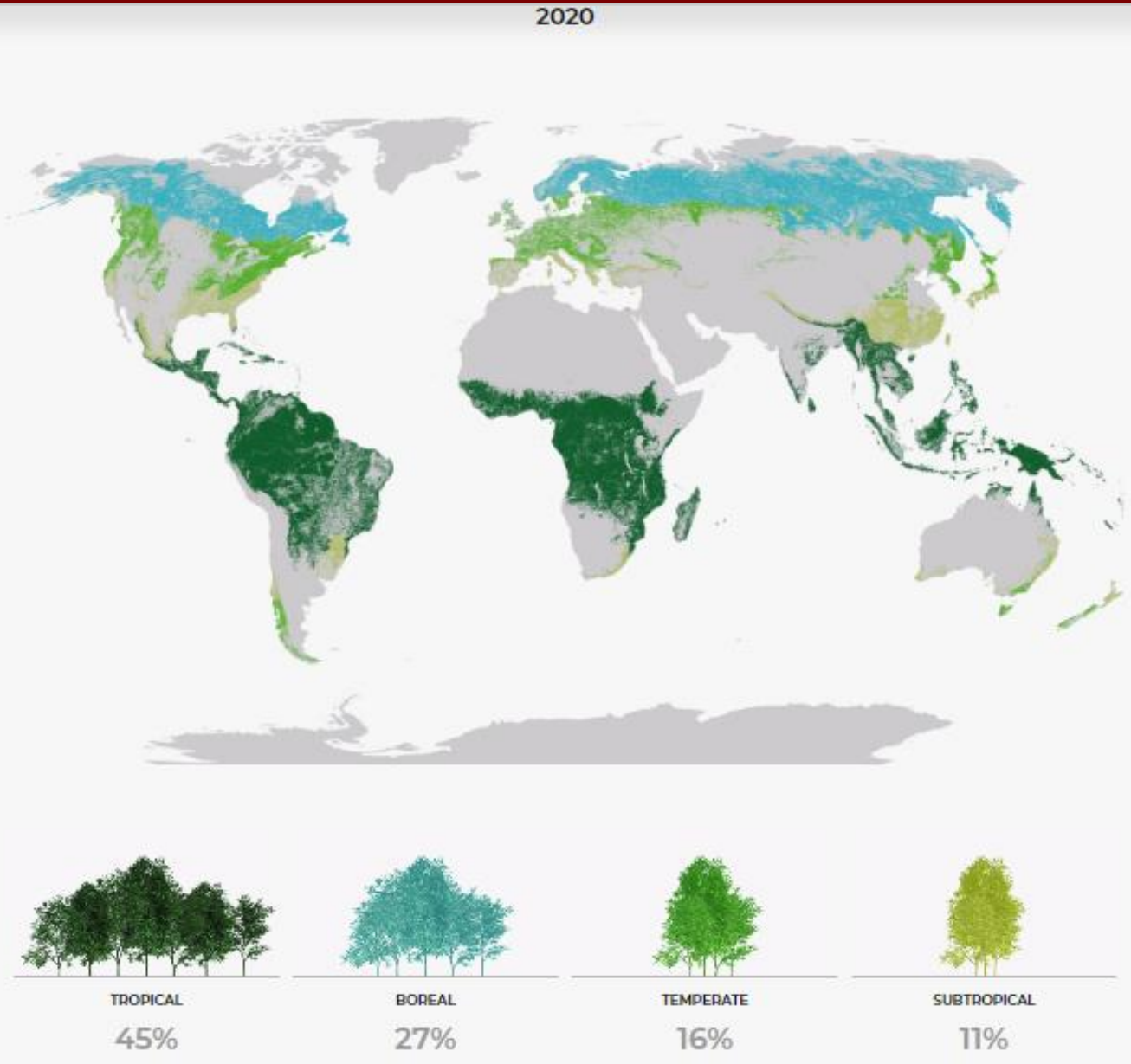


Renewable ≠ **Infinite**

The origin of wood

Where does the wood come from?

The origin of wood – Natural and semi-natural forests



The origin of wood

Where does the wood come from?

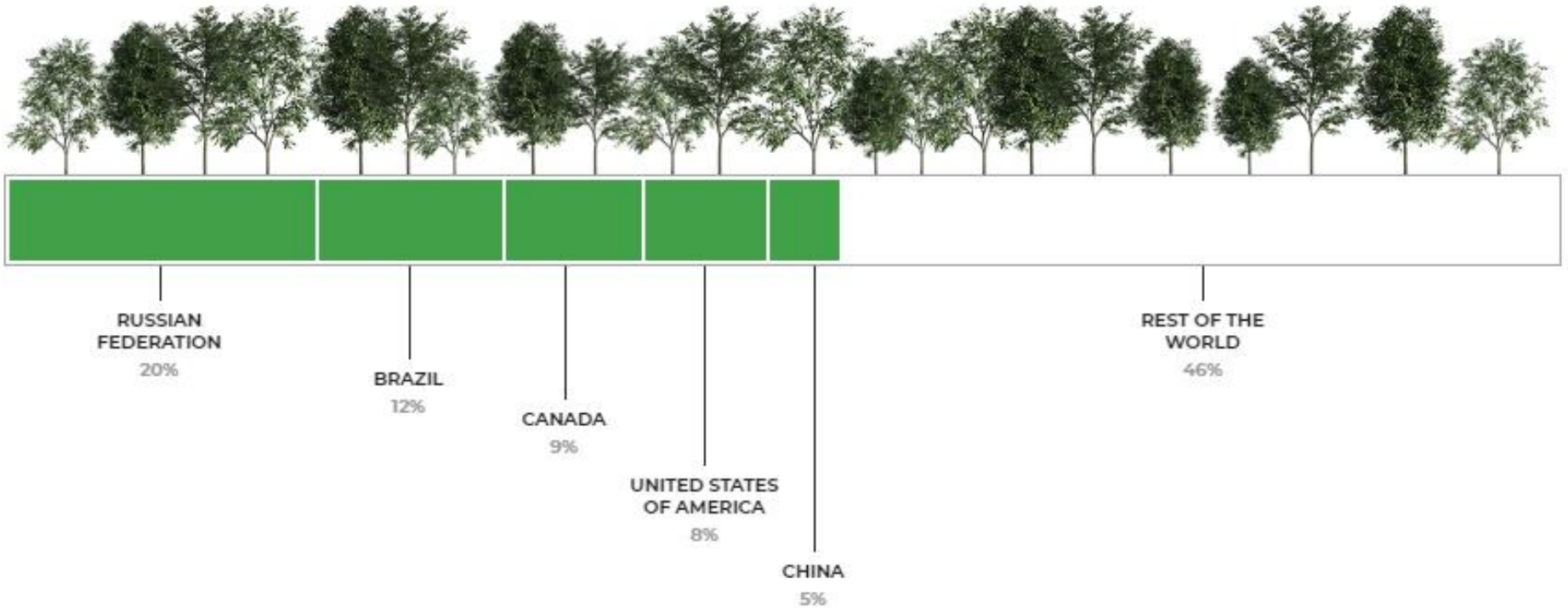
Forests

- **Natural** ≈ 1.0 billions ha
- **Semi-natural** ≈ 2.7 billions ha

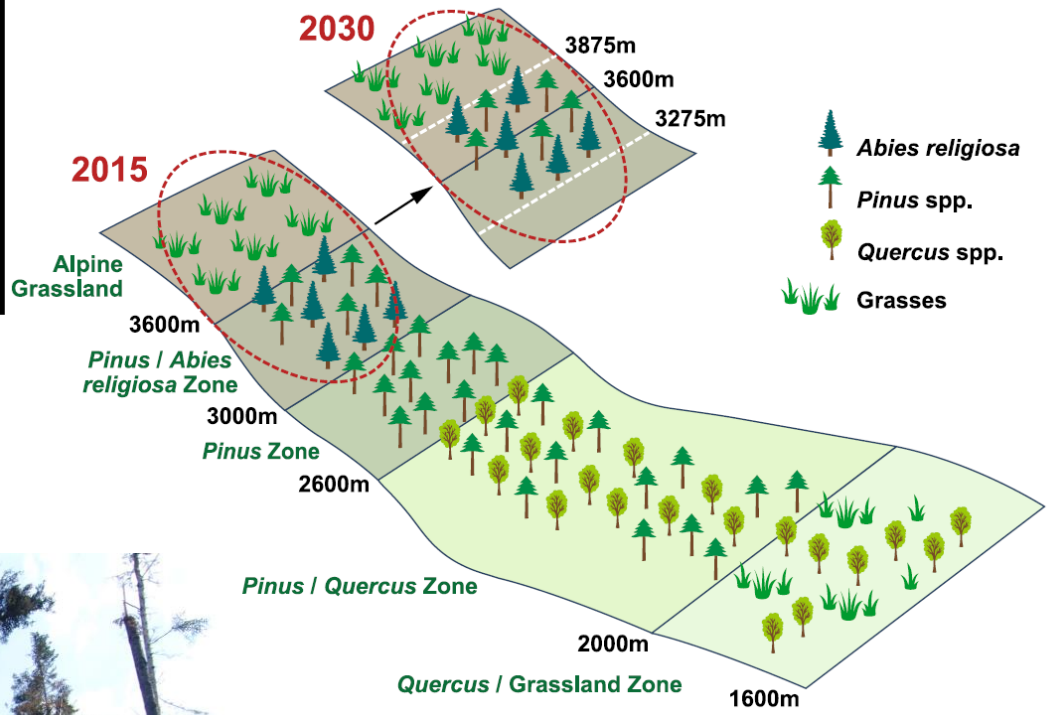
3.7 billions ha

Plantations — **0.3 billions ha**

The origin of wood – Natural and semi-natural forests

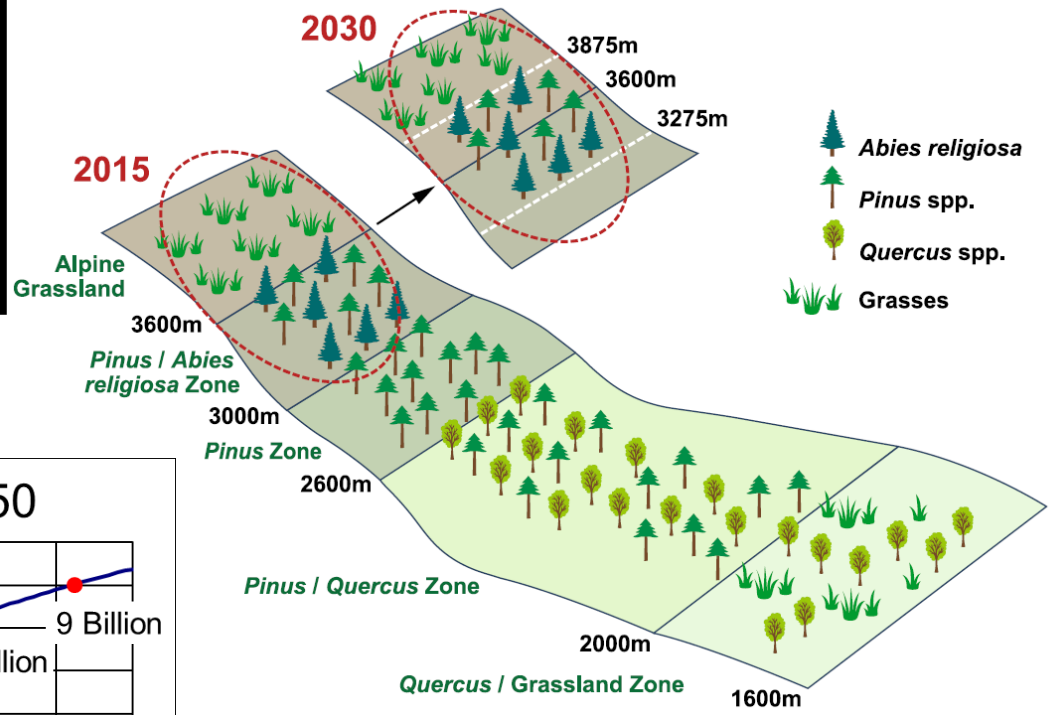


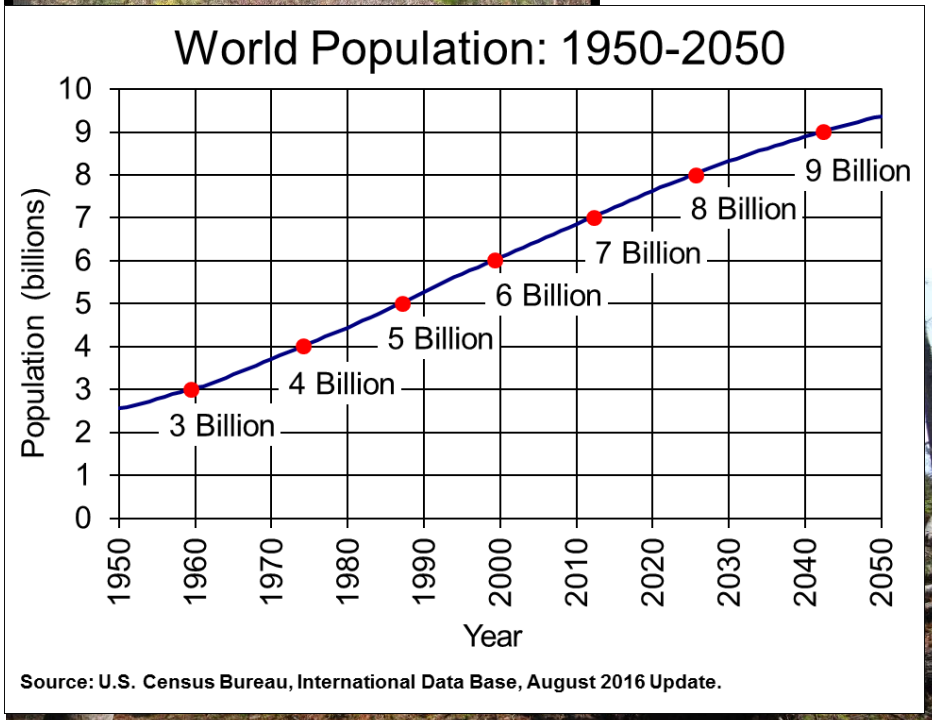
Increasing population in a changing climate…



Source: Dumroese et al. 2015. Considerations for restoring temperate forests of tomorrow: forest restoration, assisted migration, and bioengineering. *New Forests* 46: 947-964.

Increasing population in a changing climate…





Source: Dumroese et al. 2015. Considerations for restoring temperate forests of tomorrow: forest restoration, assisted migration, and bioengineering. *New Forests* 46: 947-964.

The origin of wood – some data (year 2015)

Considering world forests:

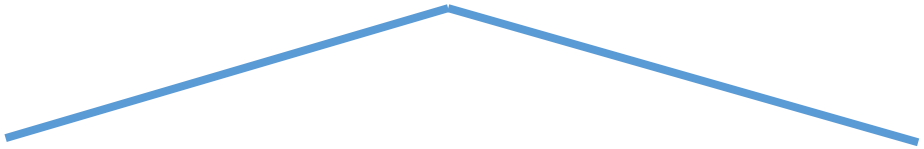
- 31% are mainly dedicated to wood production
- 28% are managed for «multiple uses»
- 30% are fundamental for soil and water protection
- 13% are dedicated to preserve biodiversity (natural protection)

531 billions of m^3 – World wood stock

295 Gt of carbon stocked in wood

World wood prosduction – some data (year 2015)

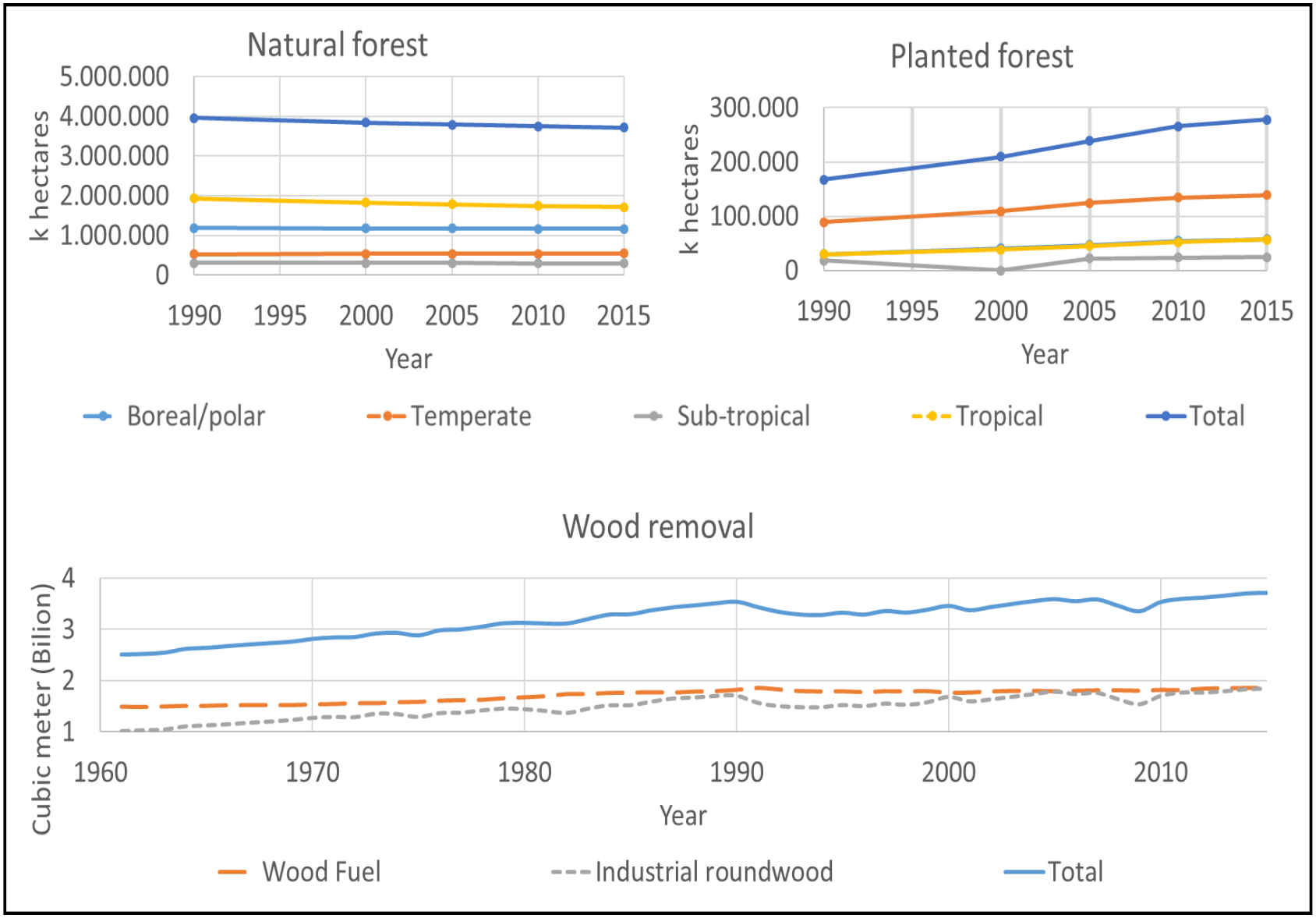
3.96 Gm^3 of wood processed at world level



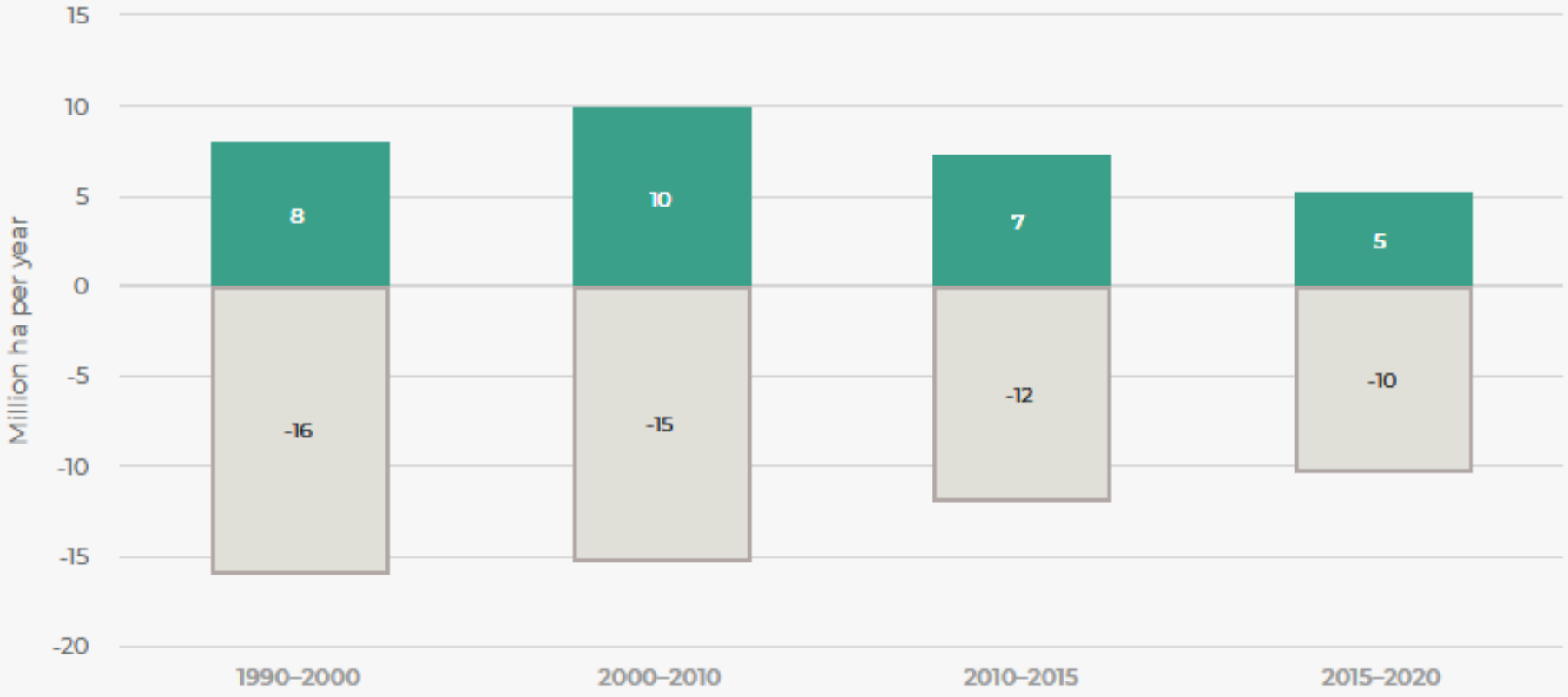
1.37 Gm^3 of conifers

2.59 Gm^3 of broadleaves

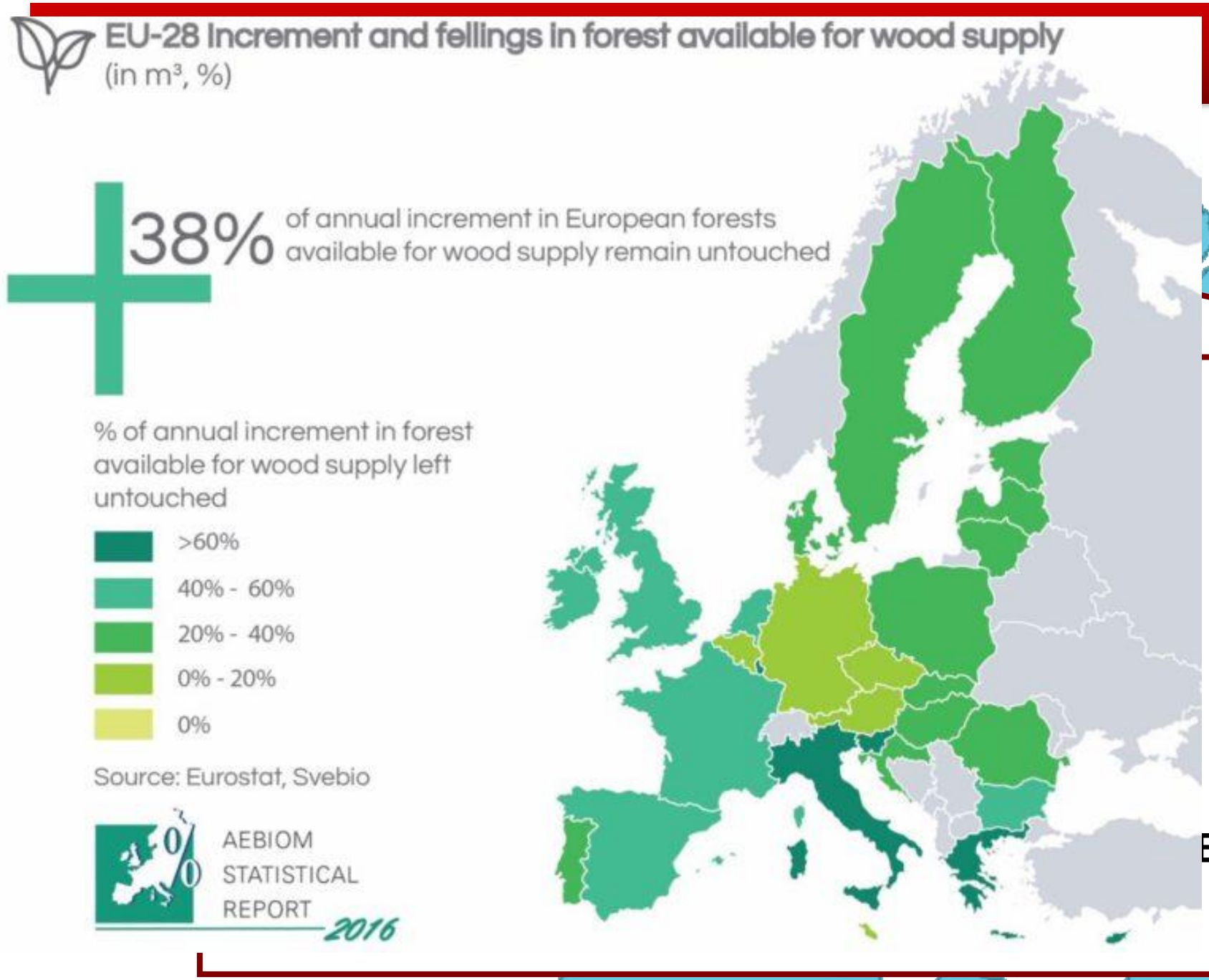
… the effects on wood demand and forest surface



The origin of wood – Natural and semi-natural forests



Increase of forest areas < **Loss of forest areas**


EU-28 Increment and fellings in forest available for wood supply
(in m³, %)
38%
of annual increment in European forests available for wood supply remain untouched
% of annual increment in forest available for wood supply left untouched
>60%
40% - 60%
20% - 40%
0% - 20%
0%
Source: Eurostat, Svebio
AEBIOM STATISTICAL REPORT
2016

FAO, EFI

The origin of wood – Deforestation

Wood harvesting in managed forests is NOT deforestation

Deforestation is mainly caused by:

- **New agricultural fields;**
- **Pastures;**
- **Illegal logging:**

Wood and Forest sector for a sustainable development

No-renewable resources *Vs* Renewable resources

Principle of sustainability

Wood

Energy

Timber

RED 2009/28/EC

20% renewable energy

Of which 42% from wood

European Wood demand
From 2010 to 2030
Extimated increase
between 10 and 200
millions of m^3

Wood supply chain

Forest

Wooden products

What between forests and wood as material?

Forest management and forest operations

Forest Management

Aimed to maximize the benefits of forests…

Wood

Soil and water protection

Biodiversity

Recreational activities

…without compromising the functionality of forests

Forest management and forest operations objectives

Economics

Productivity

Product quality

+ incomes
- costs

Work processes optimization

+ health & safety
- Injuries

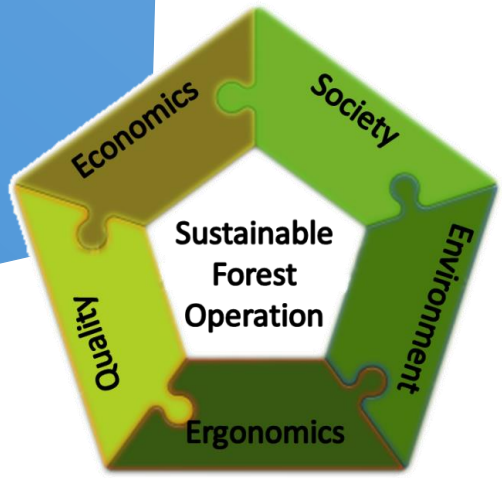
Workers' H&S improvement

Environment

Reduction of impacts

Society

Ecosystem services

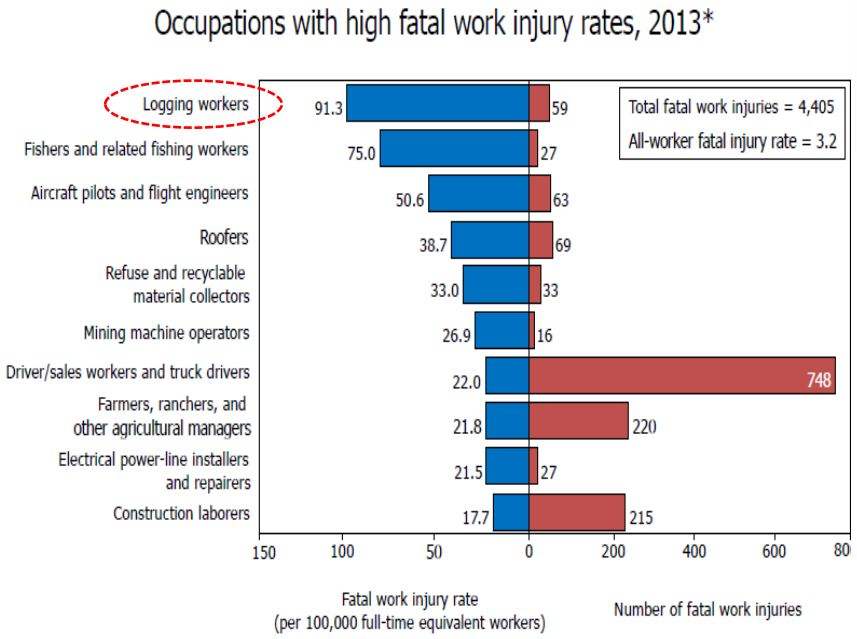


Environmental impacts

- **Soil compaction and rutting** – erosion, mudflow, effects on regeneration and tree growth
- **Damage** to regeneration
- Damage to residual trees

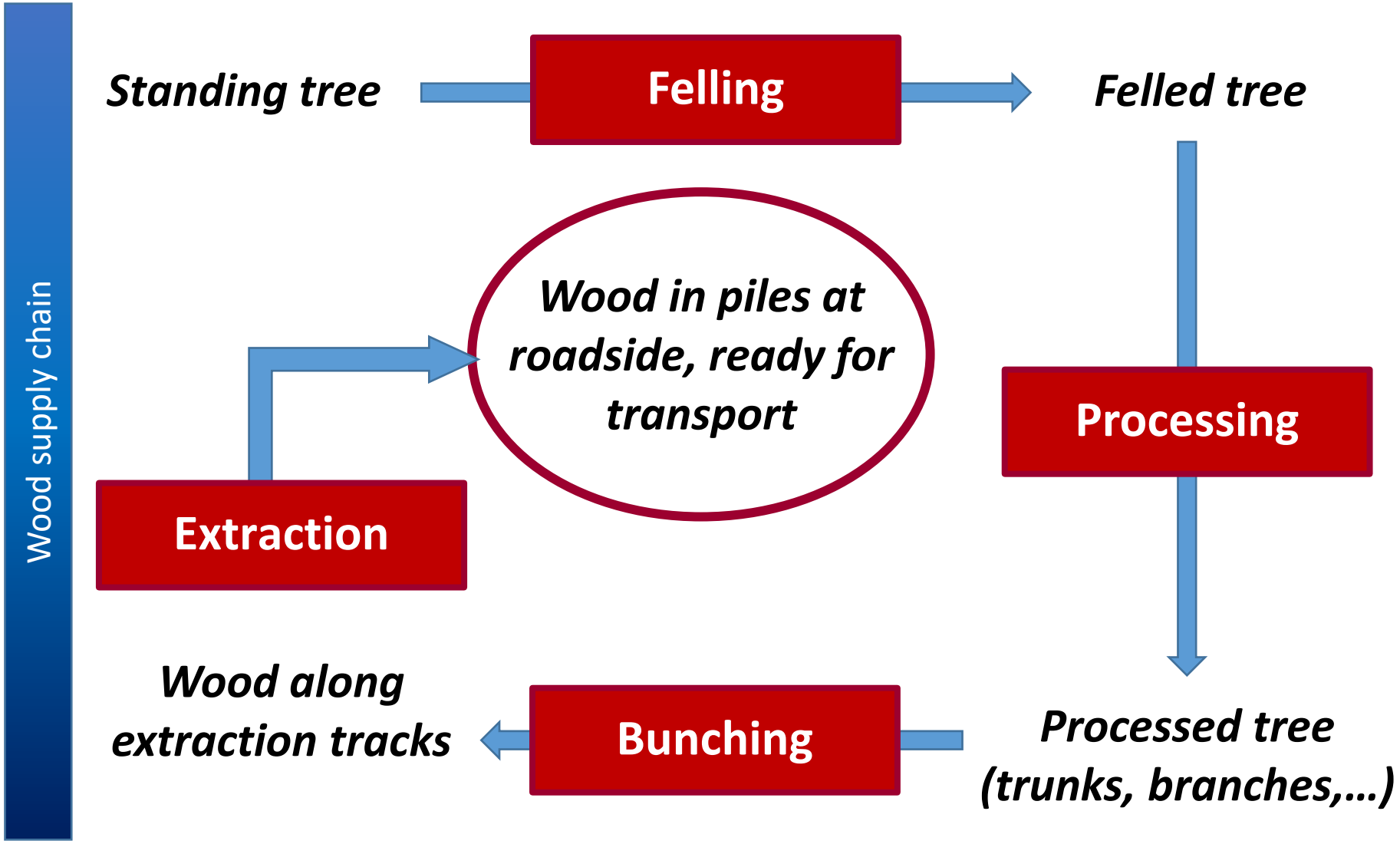
Forest workers' health and safety

- Forest work is considered **one of the most dangerous occupations worldwide** - included into the ‘‘hard work category” by ILO
- Forestry has higher **accident rates** than most other industries
- Forest operation may cause **occupational disease** (noise, vibrations, wood dust, exhaust fumes)



(Data Source: US National Institute of Health 2014)

Wood harvesting



Felling

This is the first operation to obtain wood from forests. Trees have to be felled in the best direction

Semi-mechanized

High-mechanized

Semi-mechanized felling

Chainsaw

Was born after the First World War

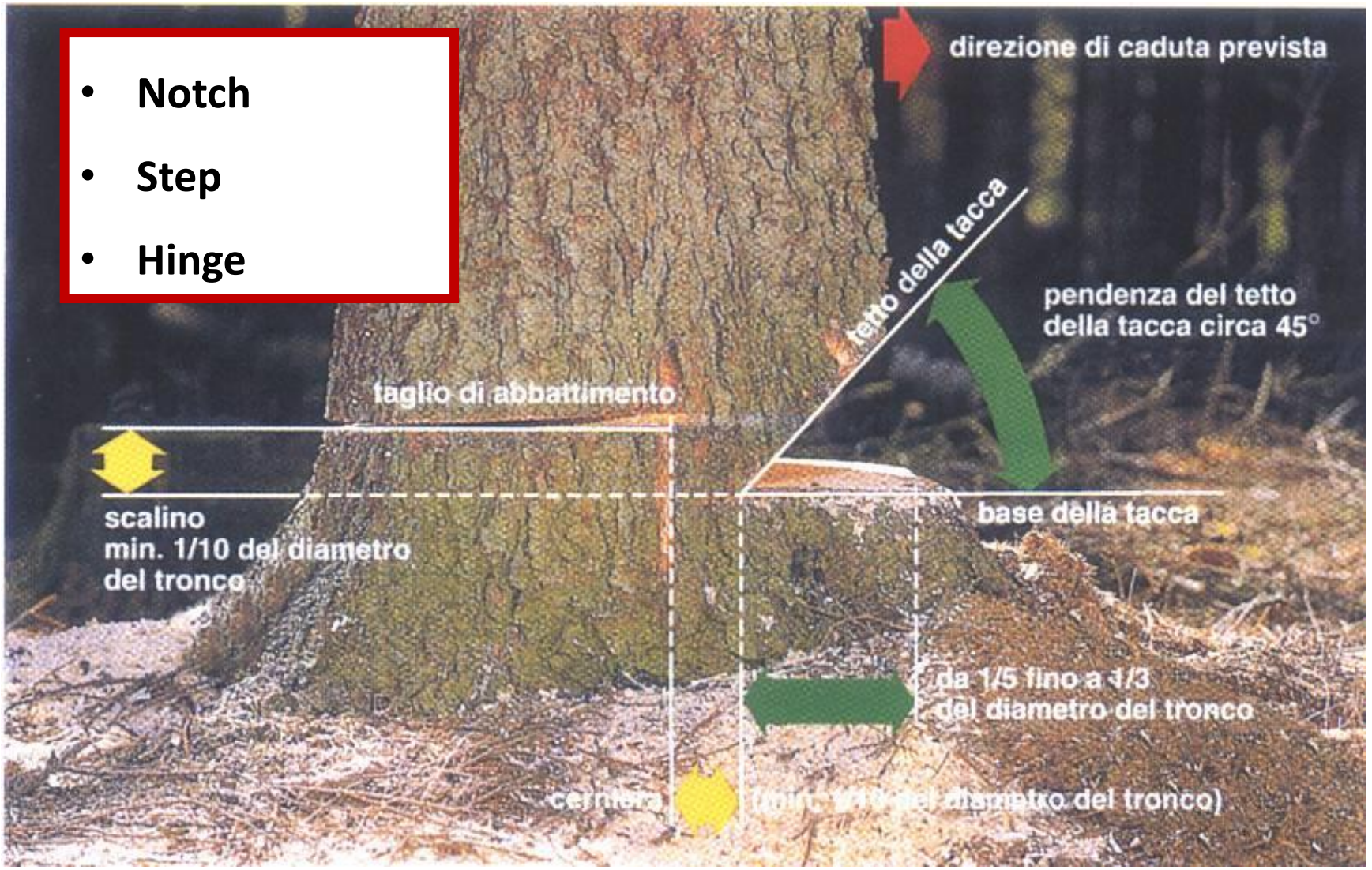
Largerly used in USA since 50’s

Very used in felling

In Italy from ’60

Classic felling technique

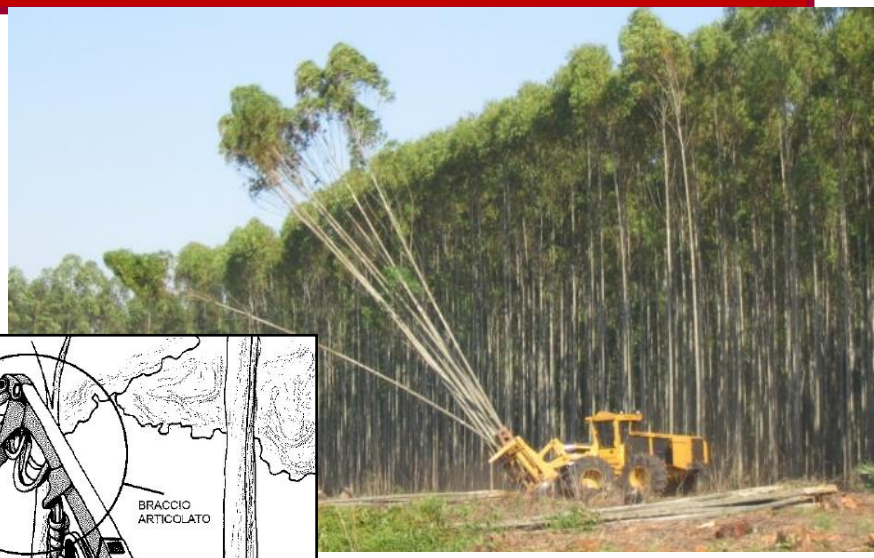
- Notch
- Step
- Hinge

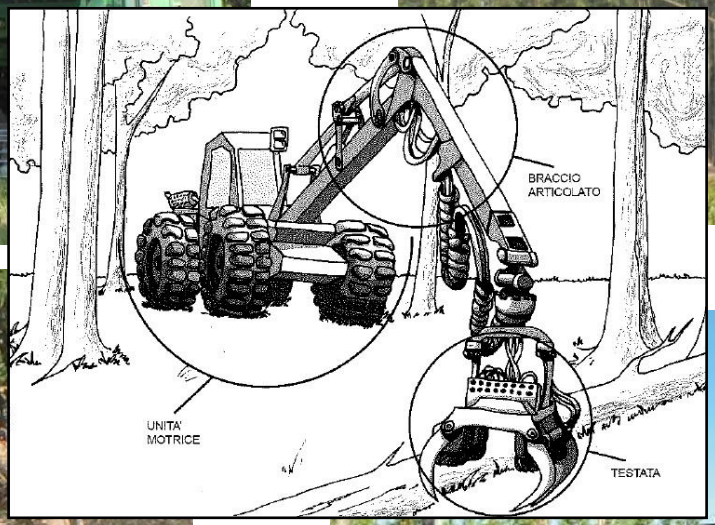


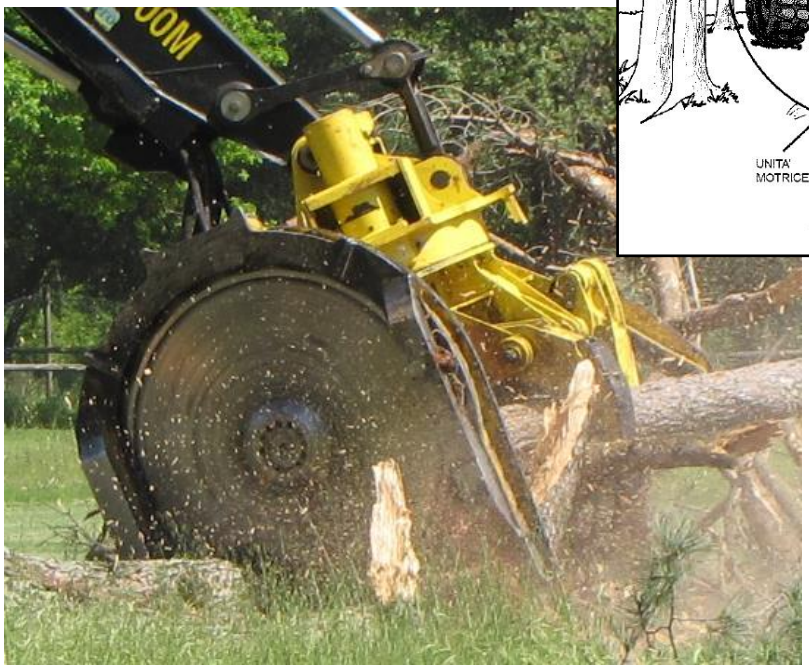
Classic felling technique

- Notch
- Step
- Hinge

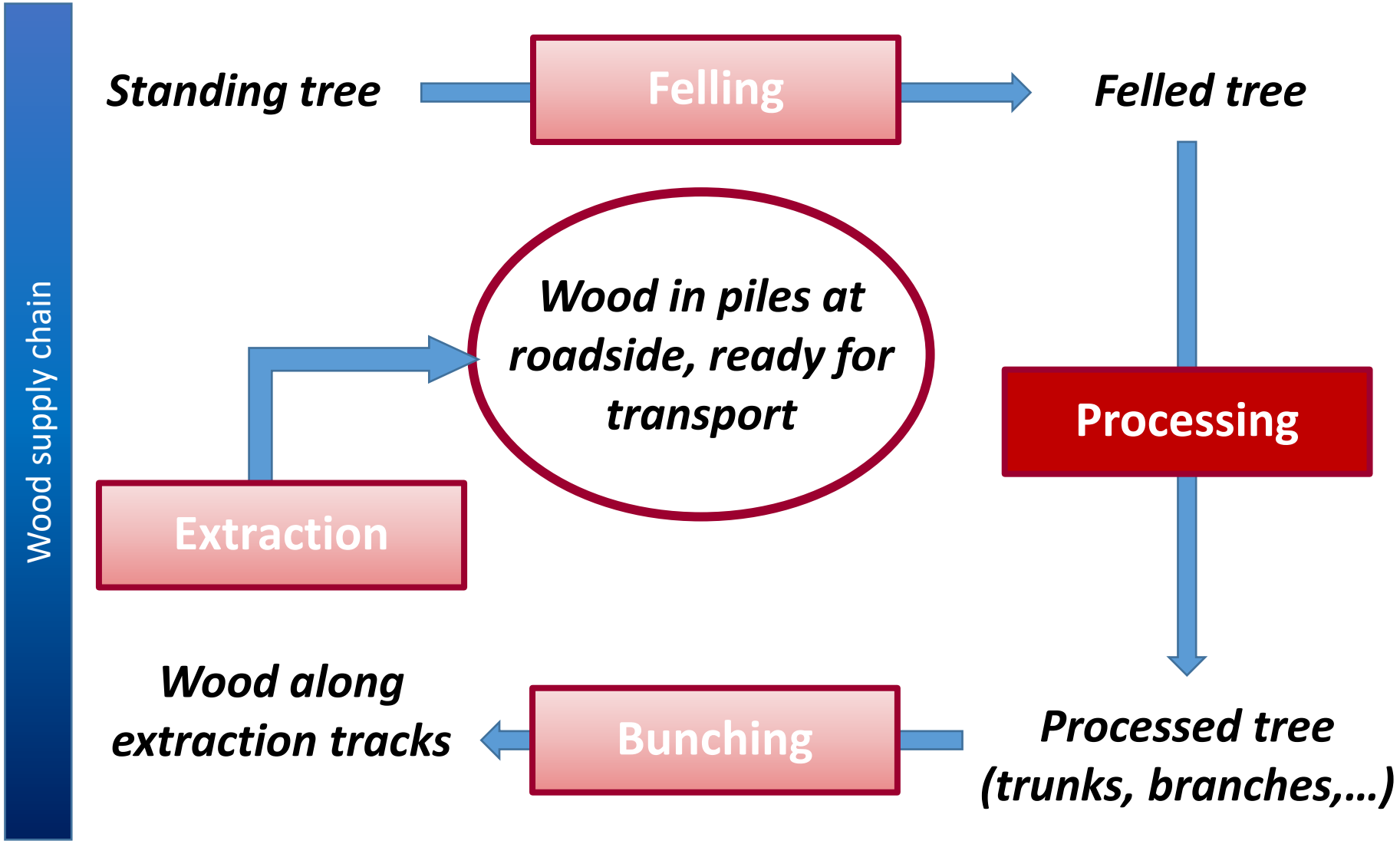
Feller- Harvester







Wood harvesting



Processing

In this phase the operator divide the tree in commercial assortments to be sent to industrial first transformation. In semi-mechanized worksites, it is carried out inside the forest, while in high-mechanised contexts it is operated at roadside.

Debranching

Cross-cutting

Delimbing

Semi-mechanized processing

Chainsaw

Was born after the First World War

Largerly used in USA since 50’s

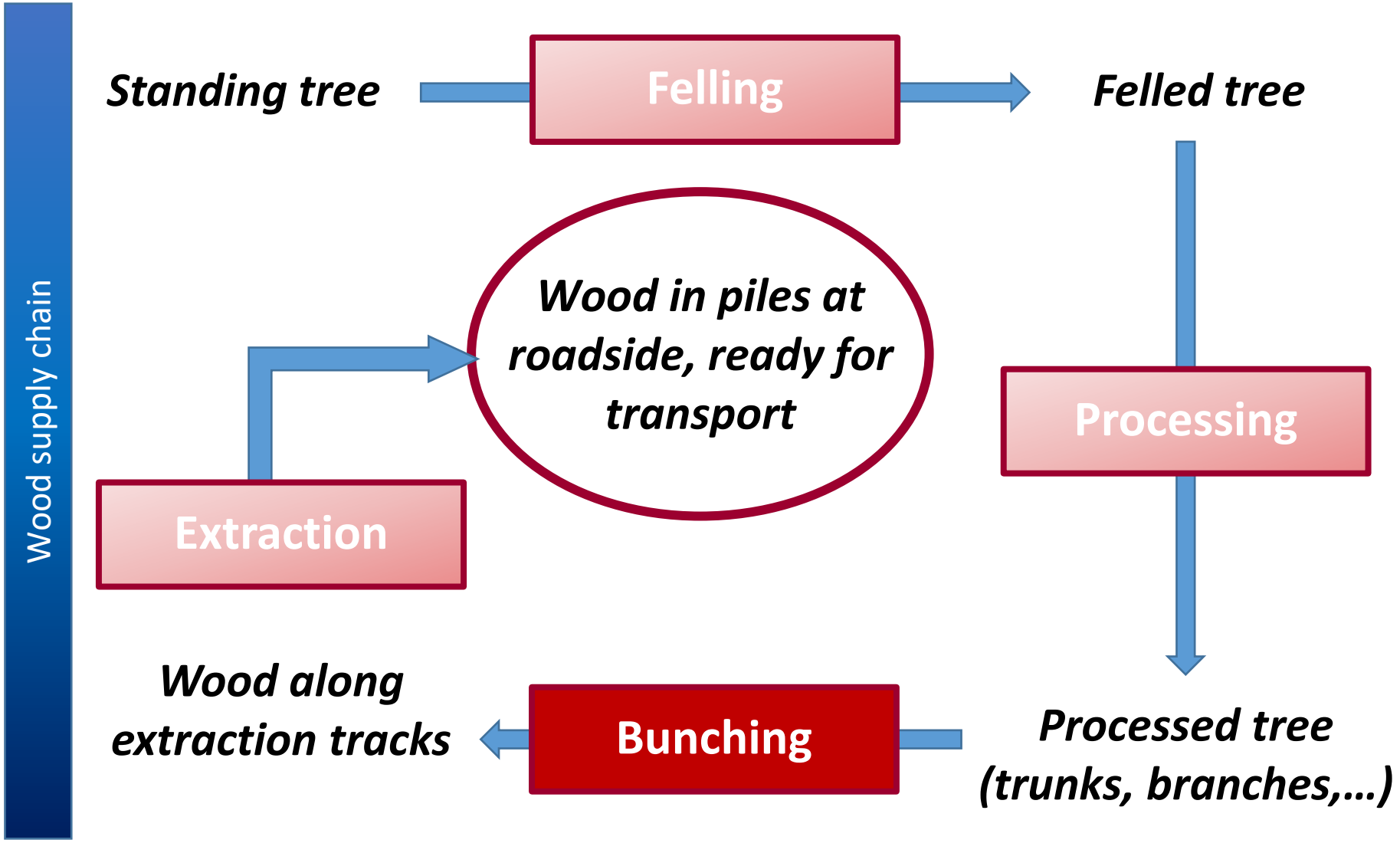
Very used in felling

In Italy from ’60

PROCESSOR

Chipper

Wood harvesting



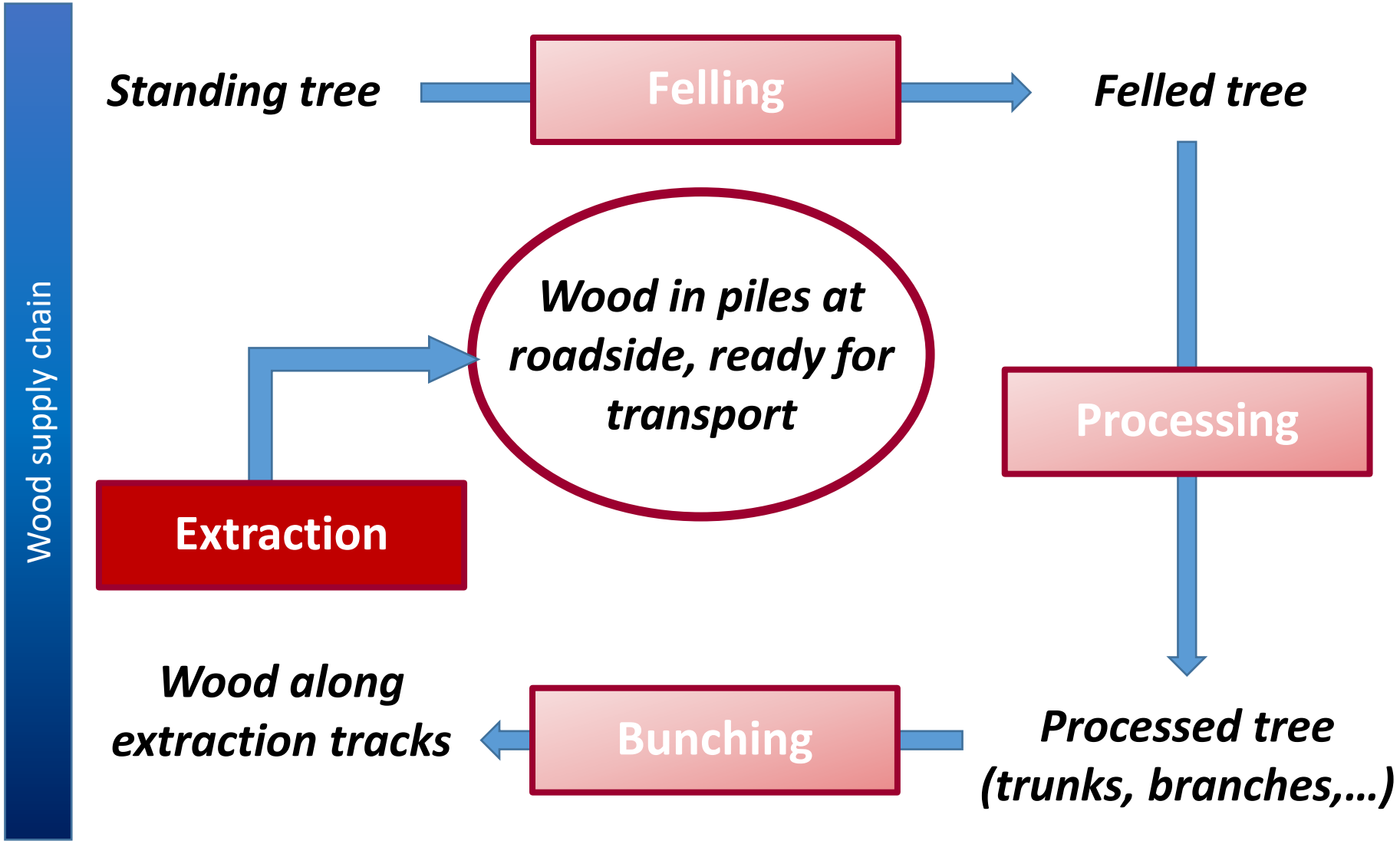
Bunching

Bunching - traditional

Bunching - mechanized

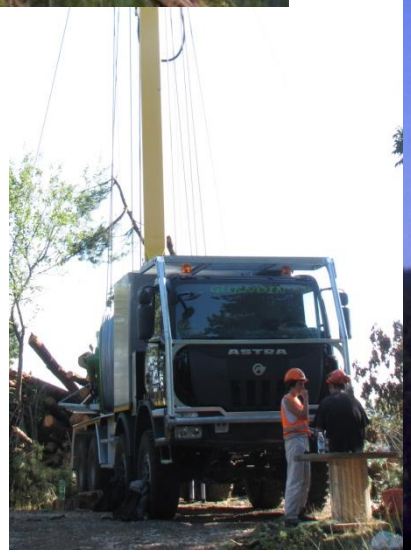
Winch

Wood harvesting

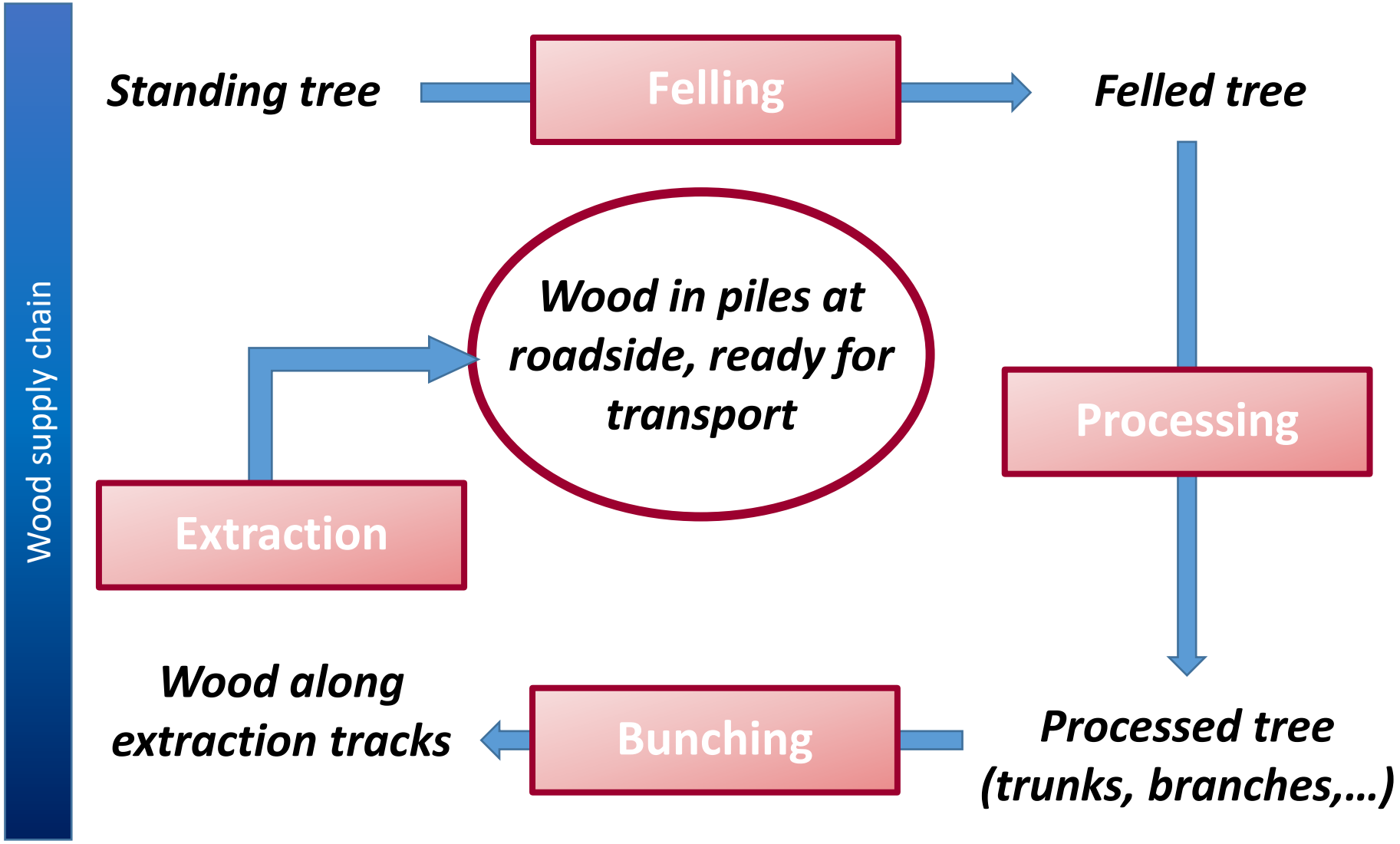


Extraction

Extraction - Aerial



Wood harvesting

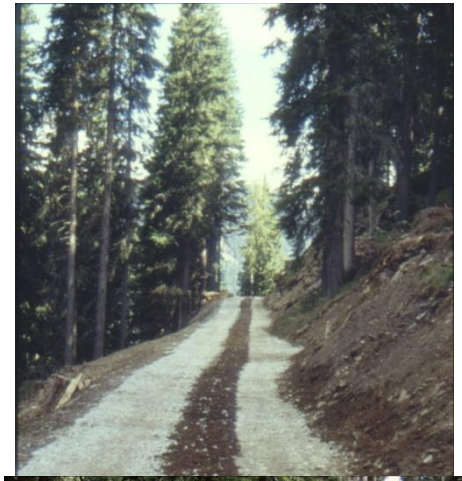


Transport


SHEFFIELD & Co Ltd
FORESTRY CONTRACTORS
SCANIA
SOUTHWAITE
CARLISLE


DAF


KiwiRail
9043

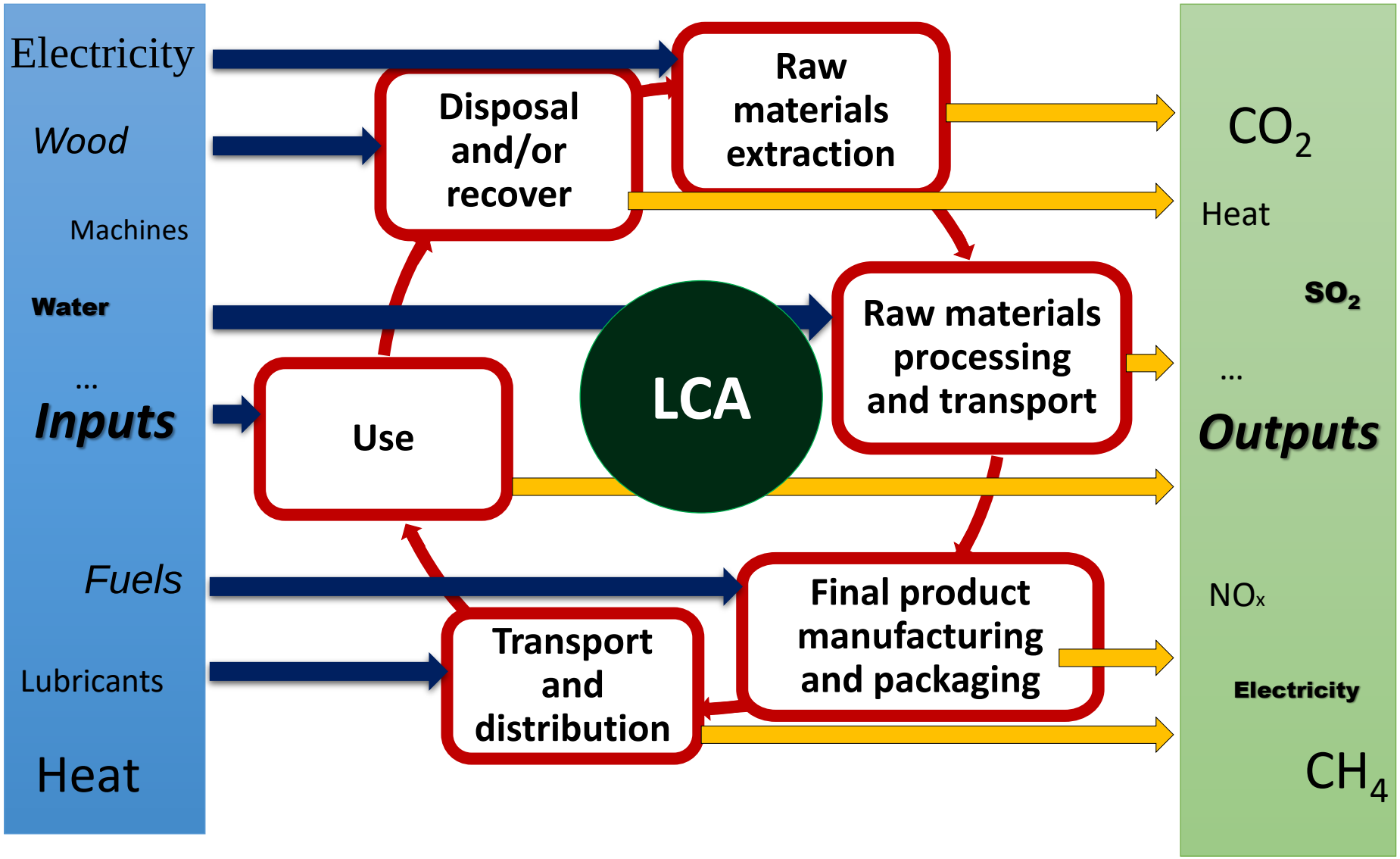



EPSILON


CAT


CAT

Forest management and wood extraction on LCA

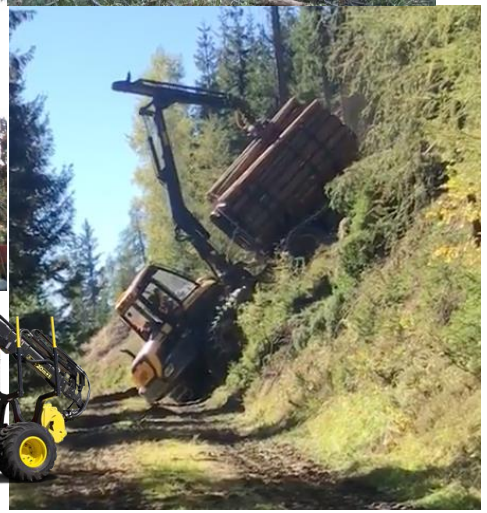


Mechanization level as an important factor

Mechanization level

Low

High



Soil compaction due to forest operations

Changes in soil-atmosphere exchanges:

- **Losses in CH_4 absorption**
- **Emission of N_20**

(Tepee et al., 2004)

Compacted surface

SWS: 30% - WTH: 13,5% (Lucci, 1987)
SWS: 32% - WTH: 19% (Picchio, 2016)

CH_4 **(IPCC, 2001)** **N_2O**

SWS1: +10% CO_{2eq}
SWS2: +15% CO_{2eq}

WTH1: +3% CO_{2eq}
WTH2: +9% CO_{2eq}

Abies alba Mill. (Pinaceae)

Abete bianco (IT)
Silver fir (UK)
Sapin (FR)
Tanne (DE)


ReD PlaNeTiNC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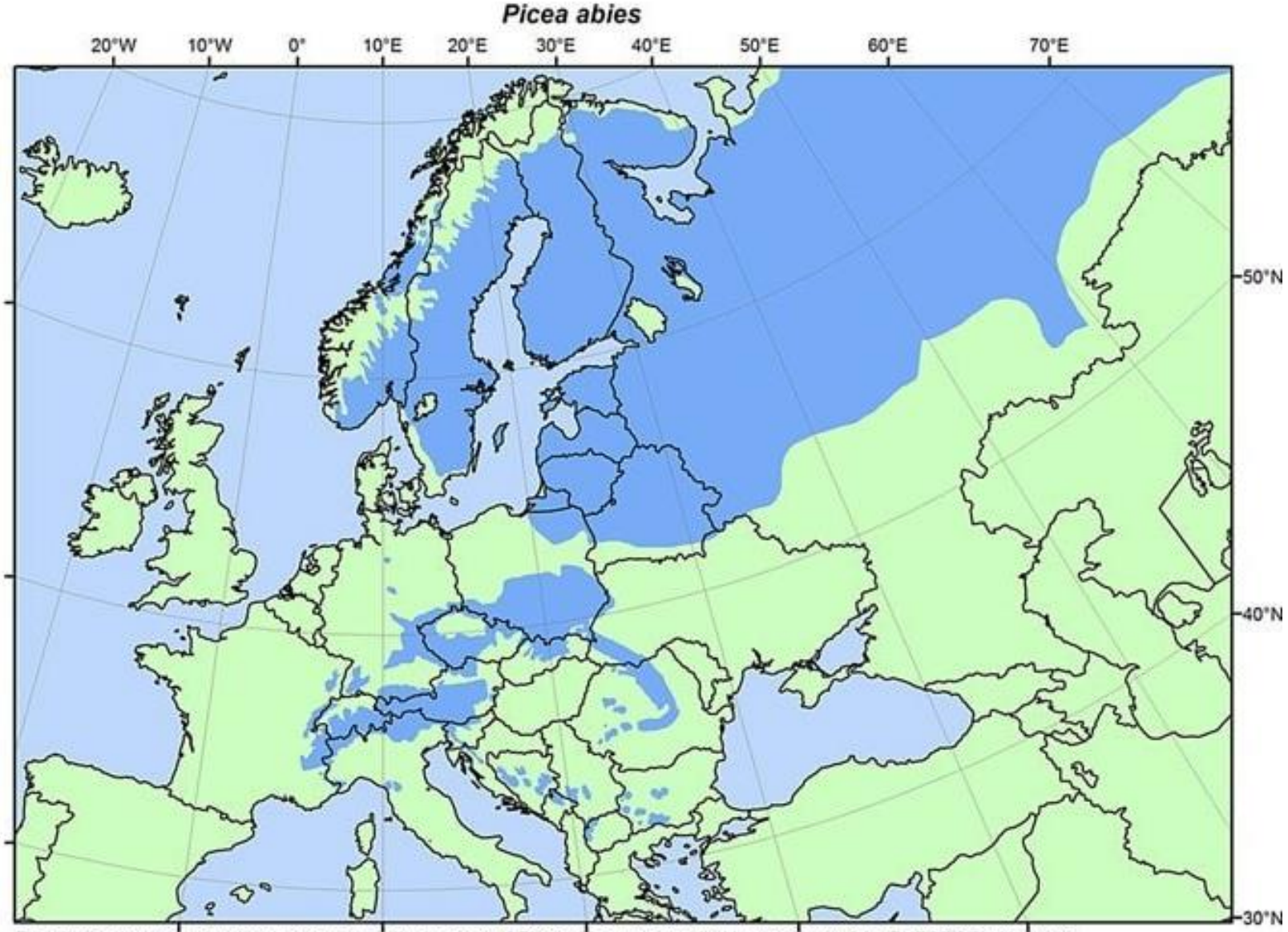
Abies alba
20°W
10°W
0°
10°E
20°E
30°E

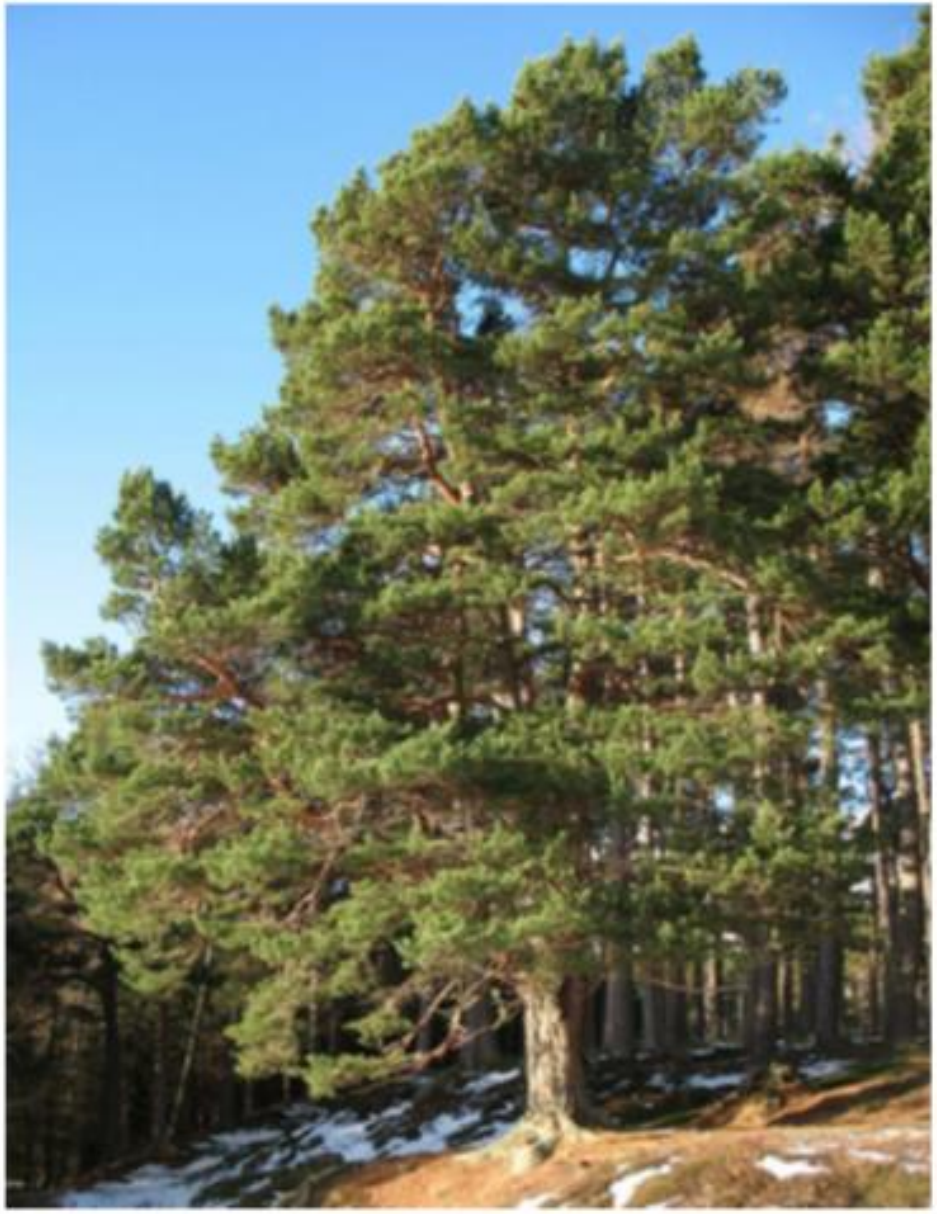

1 mm

Picea abies (L.) Karst. (Pinaceae)



This distribution map, showing the natural distribution area of *Picea abies* was compiled by members of the EUFORGEN Networks based on an earlier map published by H. Schmidt-Vogt in 1977 (Die Fichte, Verlag Paul Parey, Hamburg and Berlin, p.647).

Pinus sylvestris L. (Pinaceae)



Pino silvestre (IT)
Scots pine (UK)
Pin sylvestre (FR)
Kiefer (DE)
Pino albar (ES)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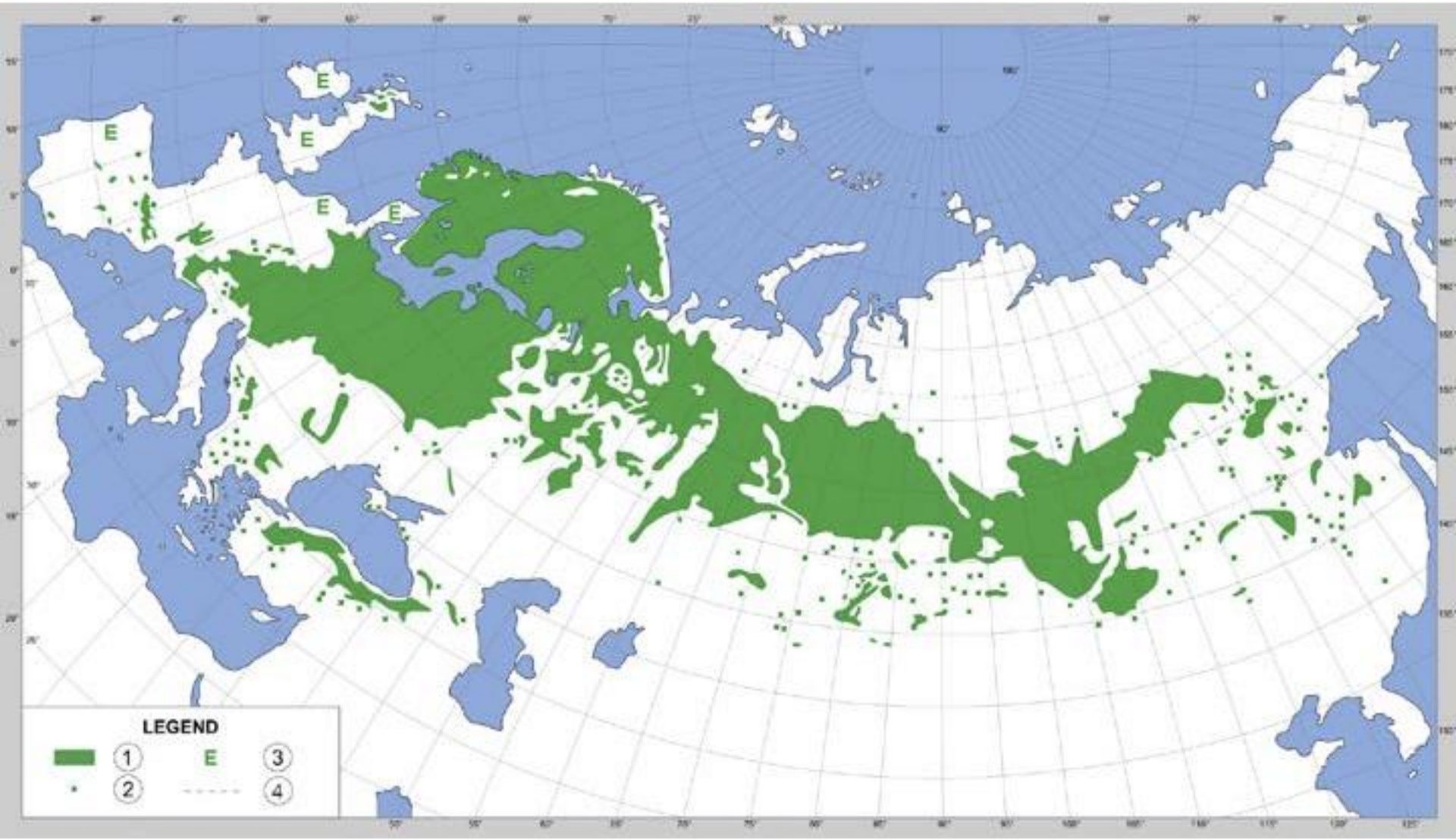
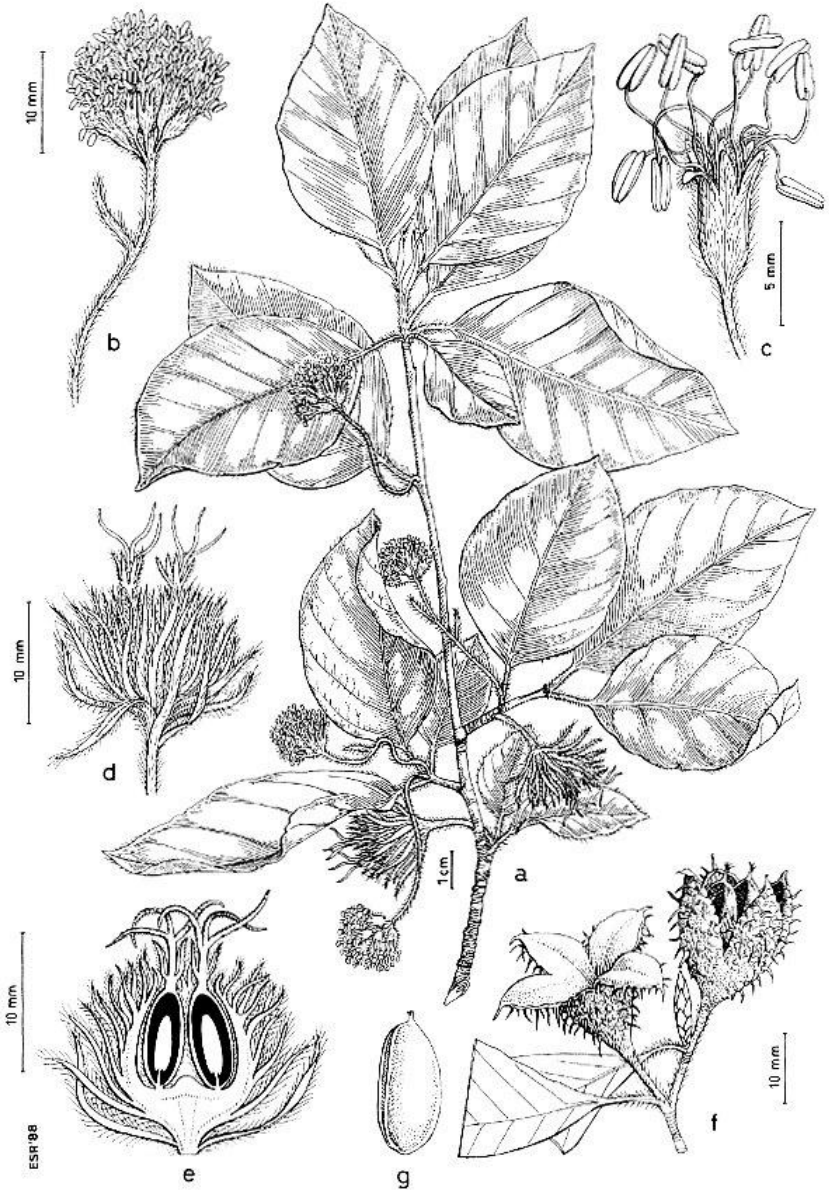
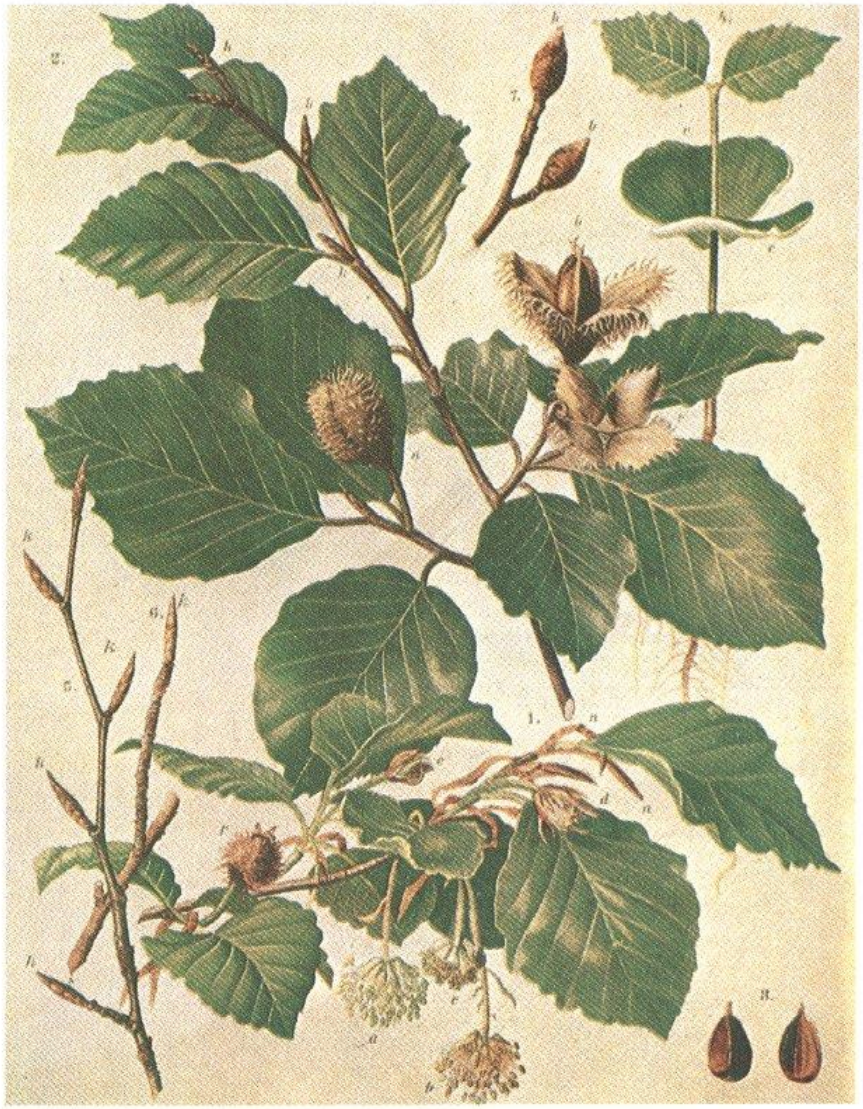
1 mm


E
E
E
E
E
LEGEND
1
E
3
2
4

Fagus sylvatica (Beech)



Lám. 3.–*Fagus sylvatica*, Maresme, Barcelona (BC 622283): a) rama florida; b) amento masculino; c) flor masculina; d) inflorescencia femenina; e) ídem en corte longitudinal; f) ramita fructífera con cúpulas; g) aquenio.



FAGUS SYLVATICA L.

1. Ramo con giovani getti, infiorescenze maschili *(a-c)*, infiorescenze femminili *(d-f)* e stipole *(n)*. 2. Ramo con getti sviluppati, con cupola ancora chiusa *(a)*, cupola aperta e acheni *(b)*, cupola priva di acheni *(c)* e gemme vegetative *(k)*. 3. Frutti maturi. 4. Plantula con cotiledoni *(c)*. 5. Ramo con gemme vegetative *(k)* in inverno. 6. Brachiblasto poliannuale con gemme vegetative *(k)* durante l'inverno. 7. Ramo con gemme a fiore *(b)*.

del faggio (*Fagus sylvatica*)

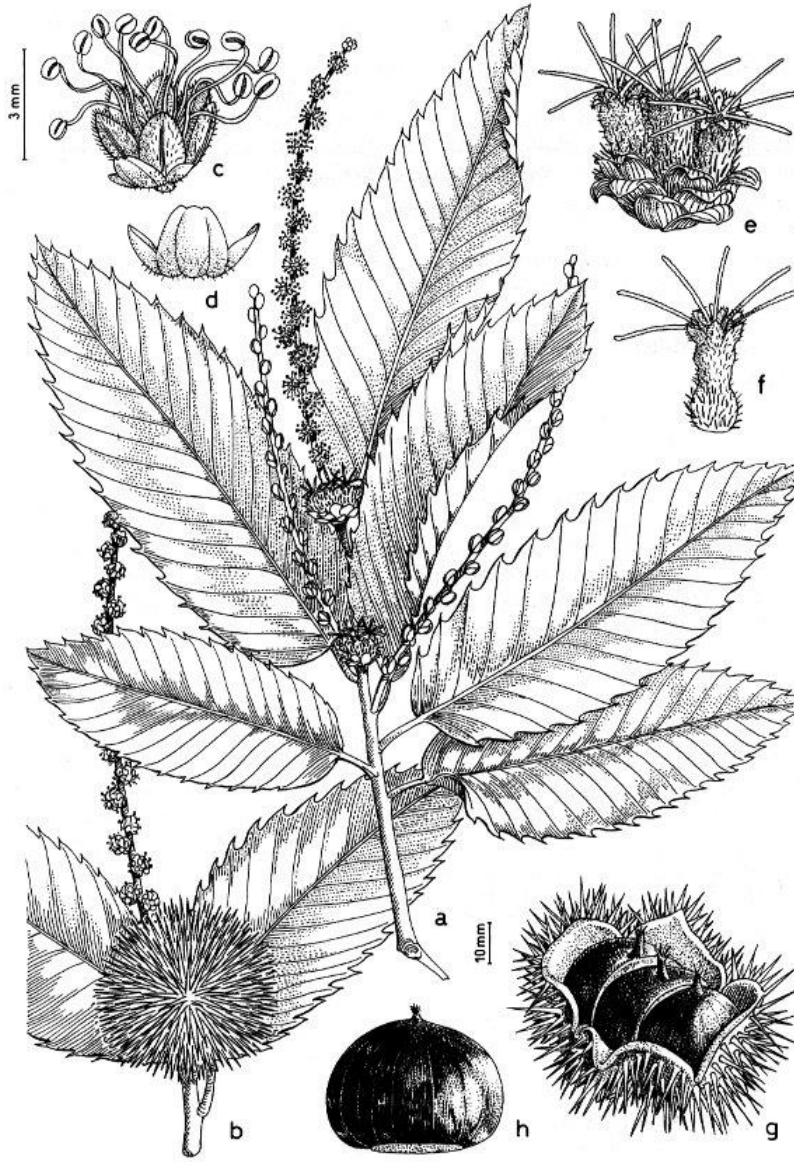
La distribuzione geografica naturale del faggio, *Fagus sylvatica,* e (in nero) le aree principali occupate da boschi di faggio.

Castanea 12 sp. in Europa, America e Asia (emisf. boreale)

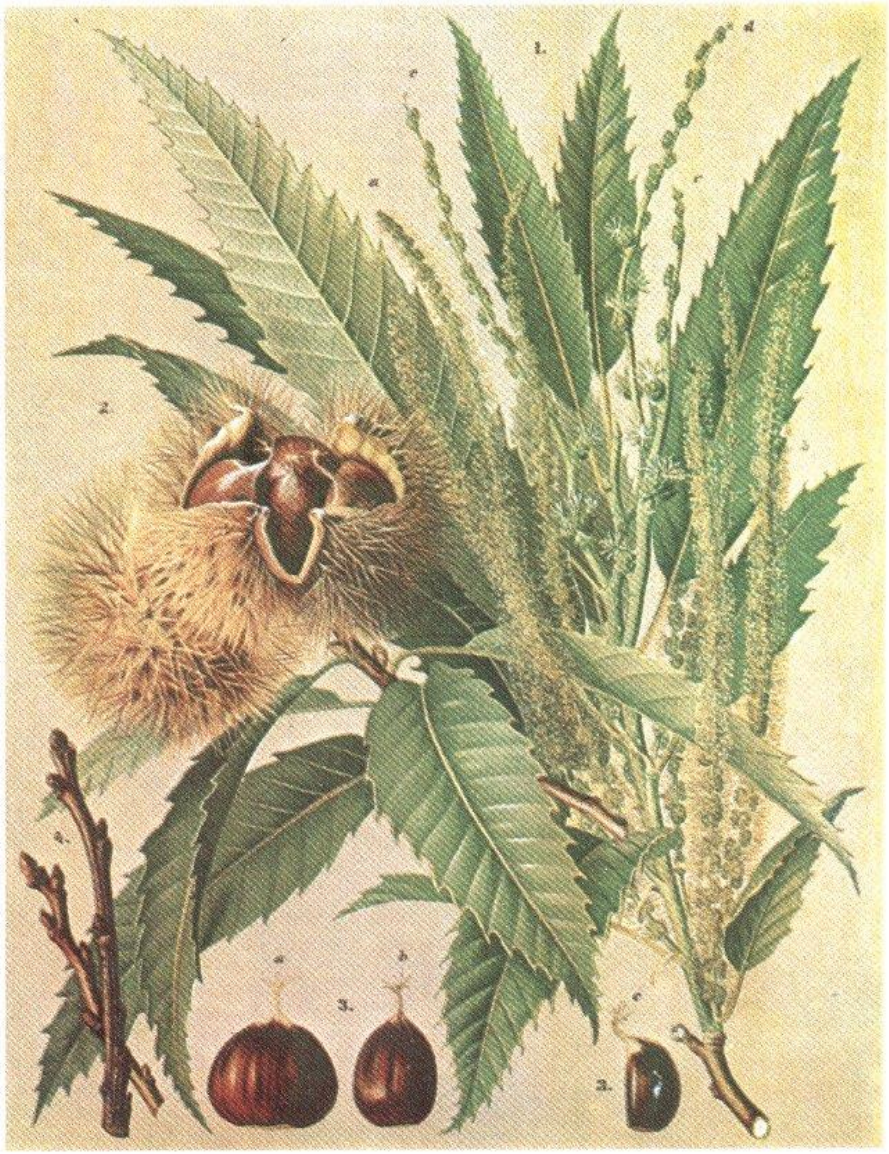
In Europa esiste solo ***C. sativa (castagno)***

- **Aspetto**: Grande albero, assai longevo. Portamento e fusto a sviluppo variabile. Chioma molto espansa, rotondeggiante; fogliame denso
- **Ritidoma** liscio da giovane, poi rugoso e fessurato, grigio-marrone
- **Rametti** glabri e lucidi, con lenticelle ben visibili; gemme ovoidi
- **Foglie** grandi (fino a 20 cm), ovato-lanceolate, acute, con margine dentato, con breve picciolo, vischiose (peli ghiandolari) da giovani
- **Fioritura tardiva. Fi. masc.** in glomeruli su amenti eretti (spighe). Ciascuno con molti stami (8-12) e un piccolo perianzio 6-lobato. Impollinazione entomofila (emanano odore intenso)
- **Fi. femm.** alla base di amenti misti. Riuniti a tre dentro un involucro di squame. Ciascuno è formato da 6(9) carpelli bi-ovulati
- **Frutto**. Si sviluppano in media tre frutti (uno per fiore, aborto di numerosi ovuli), avvolti in involucro grosso, spinoso (riccio), semi-deiscente Frutto: noce arrotondata, marrone, edule. Ricca di amido dolce. Importante per molti animali
- **Germinazione:** ipogea

Castanea sativa (Chestnut)

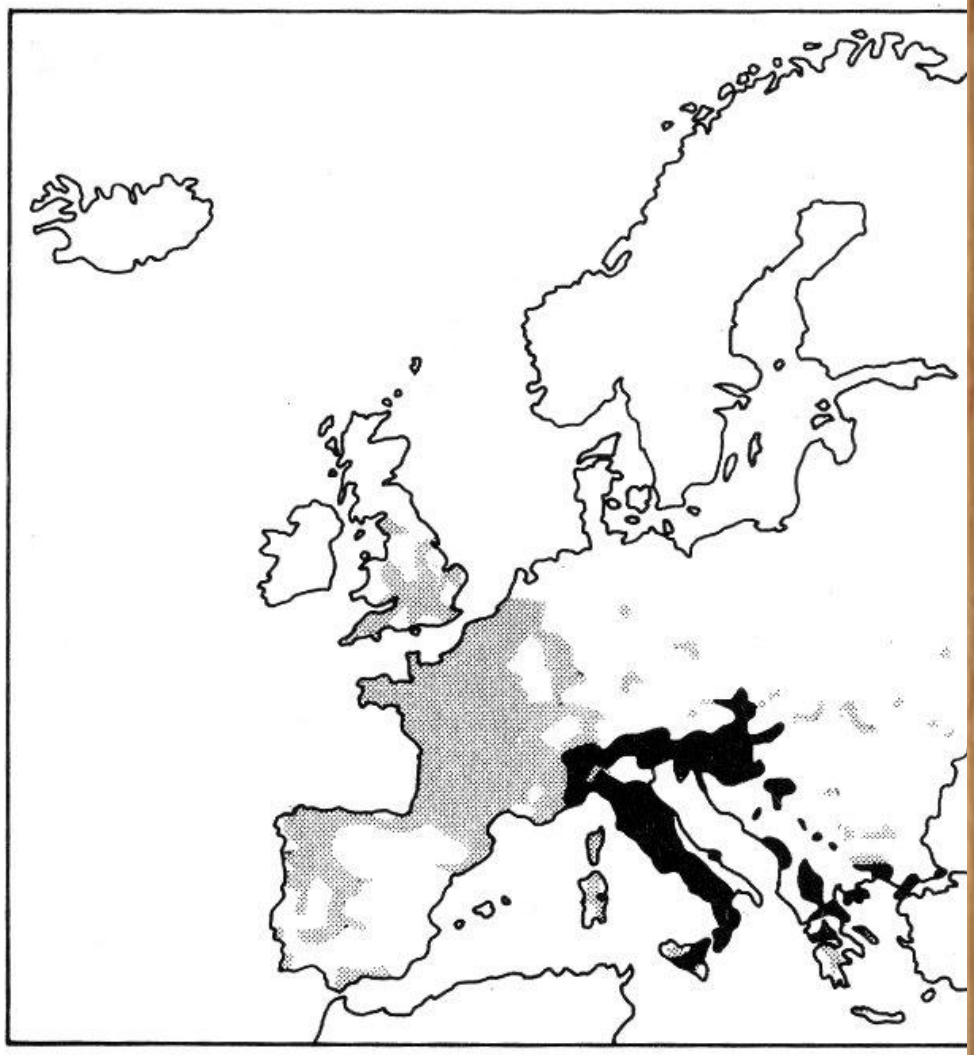


Lám. 4.–*Castanea sativa*, Frama, Cantabria (MA 25930): a) rama florida; b) ramita con cúpula y am
to; c-d) flor masculina y brácteas; e-f) flores femeninas; g-h) cúpula y aquenios.



CASTANEA SATIVA Mill.

1. Giovane getto con infiorescenze maschili *(a-b)*, e infiorescenze miste *(c-e)*. 2. Ramo con foglie, e riccio contenente gli acheni. 3. Frutti visti di fronte e di profilo. 4. Rami in inverno.



Cartina 37. La distribuzione attuale del castagno, *Castar*